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Title: STARTER HAVING PINION-ROTATION-RESTRICTING MEMBER FOR USE IN AUTOMOTIVE VEHICLE

VERIFIED TRANSLATION OF PRIORITY DOCUMENT

The undersigned, of the below address, hereby certifies that he/she well knows both the English and Japanese languages, and that the attached is an accurate translation into the English language of the Certified Copy, filed for this application under 35 U.S.C. Section 119 and/or 365, of:

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This is to certify that the annexed is a true copy of the following application as filed with this Office.

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[Name of Document] Specification

[Title of the Invention] Starter

[Claims]

1. A starter of the type comprising:

a motor adapted to generate a rotating force for an armature installed therein;

an output shaft adapted to rotate with the rotating force transferred thereto from the armature;

an electromagnetic switch disposed in the motor on the side opposite to the output shaft for driving a built-in plunger and turning ON/OFF an electric current;

a pinion helical-splined onto the output shaft;

a pinion rotation inhibiting member capable of engaging the pinion while intersecting a rotational direction of the pinion; and

a crank bar having a bar portion disposed outside an outer periphery of the armature and substantially in parallel with a rotary shaft of the armature, an electromagnetic force of the electromagnetic switch being transferred to the pinion rotation inhibiting member through the bar portion of the crank bar, thereby causing the pinion rotation inhibiting member to be engaged with the pinion, and

wherein the pinion whose rotation is inhibited by

engagement therewith of the pinion rotation inhibiting member is moved in a direction opposite to the motor side by the action of the helical splining and is brought into mesh with a ring gear in an engine,

characterized in that the crank bar is constituted by a combination of at least bisected first bar member and second bar member.

2. A starter according to claim 1, wherein the first bar member and the second bar member are fixed together in the combined state of the two.

3. A starter according to claim 1 or claim 2, wherein the first bar member and the second bar member are formed using materials different from each other.

4. A starter according to any of claims 1 to 3, wherein at least one of the first bar member and the second bar member has been subjected to a heat treatment.

5. A starter according to any of claims 1 to 4, wherein the crank bar has a transfer portion connected on one end side thereof to the plunger and on an opposite end side thereof to a rear end of the bar portion to transfer the electromagnetic force of the electromagnetic switch to the bar portion, the transfer portion being provided in a bent form relative to the bar portion, and the bar portion and the transfer portion being divided as the first bar member

and the second bar member, respectively.

6. A starter according to any of claims 1 to 4, wherein the crank bar has an operating portion connected to a front end of the bar portion to operate the pinion rotation inhibiting member, the operating portion being provided in a bent form relative to the bar portion, and the bar portion and the operating portion being divided as the first bar member and the second bar member, respectively.

7. A starter according to claim 1, wherein the crank bar has a transfer portion connected on one end side thereof to the plunger and on an opposite end side thereof to a rear end of the bar portion to transfer the electromagnetic force of the electromagnetic switch to the bar portion and also has an operating portion connected to a front end of the bar portion to operate the pinion rotation inhibiting member, the transfer portion and the operating portion being provided in a bent form relative to the bar member, and the crank bar is divided into and assembled by the three portions, the bar portion, the transfer portion and the operating portion.

8. A starter according to any of claims 1 to 7, wherein the first bar member and the second bar member of the crank bar have different sectional shapes.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to a rotation inhibiting meshing type starter wherein a rotation-inhibited pinion gear is pushed out by a helical splining action into mesh with a ring gear in an engine.

[0002]

[Prior Art]

As a conventional starter there is known, for example, a starter of such a type as described in Patent Literatures 1 and 2.

This conventional starter comprises a pinion helical-splined to an output shaft, a pinion rotation inhibiting member capable of engaging the pinion, and a crank bar which causes the pinion rotation inhibiting member to be engaged with the pinion by utilizing an attractive force of an electromagnetic switch. In this starter, at the time of driving the output shaft, the pinion rotation inhibiting member is brought into engagement with the pinion to inhibit rotation of the pinion, whereby the pinion advances on the output shaft under the helical splining action and comes into mesh with a ring gear in an engine.

[0003]

[Patent Literature 1]

Japanese Patent Laid Open No. Hei 9(1997)-217672

[Patent Literature 2]

Japanese Patent Laid Open No. Hei 10(1998)-18950

[0004]

[Problems to be Solved by the Invention]

In the above conventional starter, however, since the electromagnetic switch is disposed on the side opposite to the pinion with respect to the motor, the overall length of the crank bar becomes long inevitably, and since the crank bar is bent in a generally ⊃ shape at both ends thereof, its assembling performance is extremely poor. As a result, it becomes impossible to adopt, for example, a process of stacking constituent parts of the starter in order from a front housing side, with consequent increase in the number of assembling steps and increase of cost.

[0005]

For efficient transfer of the attractive force of the electromagnetic switch it is necessary to enhance the bending accuracy at both ends of the crank bar and the assembling accuracy of the electromagnetic switch and therefore machining of the crank bar and that of the assembling parts of the electromagnetic switch have so far been difficult.

The present invention has been accomplished on the

basis of the above circumstances and it is an object of the invention to provide a starter which can improve the assembling performance and wherein the fabrication of a crank bar is easy.

[0006]

[Means for Solving the Problems]

(Invention of Claim 1)

This invention resides in a starter of the type wherein a pinion whose rotation is inhibited by engagement therewith of a pinion rotation inhibiting member is moved in a direction opposite to a motor into mesh with a ring gear in an engine by a helical splining action, characterized in that a crank bar for transferring an electromagnetic force of an electromagnetic switch to a pinion rotation inhibiting member is constituted by a combination of at least bisected first bar member and second bar member.

[0007]

According to this construction, the first and second bar members can be assembled separately at the time of assembling the crank bar, whereby the assembling performance is improved and it becomes possible to effect assembly in one axial direction.

Moreover, even if the electromagnetic switch

assembling accuracy and the crank bar machining accuracy are poor, the first and second bar members can be assembled at an appropriate position, so that machining of electromagnetic switch assembling parts and that of the crank bar become easy.

[0008]

(Invention of Claim 2)

In the starter defined in claim 1, the first and second bar members of the crank bar are fixed together in the combined state of the two.

According to this construction, since the first and second bar members can be assembled and fixed at an appropriate position, it is not necessary to enhance the crank bar machining accuracy and hence the fabrication of the crank bar becomes easier.

[0009]

(Invention of Claim 3)

In the starter described in claim 1 or claim 2, the first and second bar members are formed using materials different from each other.

In this case, the first and second bar members can be formed using materials suitable respectively for the purpose of the portion where the first bar member is used and for the purpose of the portion where the second bar

member is used.

[0010]

(Invention of Claim 4)

In the starter described in any of claims 1 to 3, at least one of the first and second bar members has been subjected to a heat treatment.

In this case, it is not necessary to perform a heat treatment for the whole of the crank bar, but the heat treatment may be performed for only one of the first and second bar members that is used in a portion requiring abrasion resistance.

[0011]

(Invention of Claim 5)

In the starter described in any of claims 1 to 4, the crank bar has a transfer portion connected on one end side thereof to the plunger and on an opposite end side thereof to a rear end of the bar portion to transfer the electromagnetic force of the electromagnetic switch to the bar portion, the transfer portion being provided in a bent form relative to the bar portion, and the bar portion and the transfer portion being divided as the first bar member and the second bar member, respectively.

According to this construction, since the first and second bar members are combined together at a bent portion

of the crank bar, it is not necessary to bend the crank bar and the bending process can be omitted, whereby it is possible to fabricate the crank bar less expensively.

[0012]

(Invention of Claim 6)

In the starter described in any of claims 1 to 4, the crank bar has an operating portion connected to a front end of the bar portion to operate the pinion rotation inhibiting member, the operating portion being provided in a bent form relative to the bar portion, and the bar portion and the operating portion being divided as the first bar member and the second bar member, respectively.

According to this construction, since the first and second bar members are combined together at a bent portion of the crank bar, it is not necessary to bend the crank bar and the bending process can be omitted, whereby the crank bar can be fabricated less expensively.

[0013]

(Invention of Claim 7)

In the starter described in claim 1, the crank bar has a transfer portion connected on one end side thereof to the plunger and on an opposite end side thereof to a rear end of the bar portion to transfer the electromagnetic force of the electromagnetic switch to the bar portion and

also has an operating portion connected to a front end of the bar portion to operate the pinion rotation inhibiting member, the transfer portion and the operating portion being provided in a bent form relative to the bar member, and the crank bar is divided into and assembled by the three portions, the bar portion, the transfer portion and the operating portion.

According to this construction, since the bar portion and the transfer portion, as well as the bar portion and the operating portion, are combined together at bent portions of the crank bar, it is not necessary to bend the crank bar and the bending process can be omitted, whereby the crank bar can be fabricated less expensively.

[0014]

(Invention of Claim 8)

In the starter described in any of claims 1 to 7, the first and second bar members of the crank bar have different sectional shapes.

In this case, the first and second bar members can have sectional shapes respectively suitable for the purpose of the portion where the first bar member is used and for the purpose of the portion where the second bar member is used.

[0015]

[Mode for Carrying Out the Invention]

Embodiments of the present invention will be described hereinunder with reference to the drawings.

(First Embodiment)

Fig. 1 is a sectional view of a starter 1.

The starter 1 of this embodiment comprises a motor 2 for generating a rotating force, an electromagnetic switch 3 for turning ON and OFF an electric current supplied to the motor 2, an output shaft 4 which is driven and rotated by the motor 2, a pinion 5 disposed movably on the output shaft 4, a pinion rotation inhibiting member 6 engageable with the pinion 5, and a crank bar 7 for operating the pinion rotation inhibiting member 6 by utilizing an electromagnetic force (attractive force) of the electromagnetic switch 3.

[0016]

The motor 2 is a known DC motor composed of a yoke 8, magnetic poles 9 (permanent magnets), an armature 10, and brushes 11. When motor contacts (to be described later) are closed by the electromagnetic switch 3, a battery current flows in the armature 10 through the brushes 11, so that a rotating force is generated in the armature 10.

The motor 2 is held grippingly between a front housing 12 which is combined with a front end side of the

yoke 8 and an end cover 13 which is combined with a rear end side of the yoke 8.

[0017]

As shown in Fig. 1, the electromagnetic switch 3 is disposed in a rear portion of the starter 1 (on a rear side of the motor 2) and is fixed in such a manner that an operating direction (the vertical direction in the figure) of a plunger 14 installed therein intersects an axial direction (the transverse direction in the figure) of the motor 2.

The electromagnetic switch 3 comprises a solenoid 15 which is energized upon turning ON of an IG switch (not shown) to produce a magnetic force, the plunger 14 which is inserted inside the solenoid 15 reciprocatably and which is attracted upward by virtue of the magnetic force, a spring 16 for pushing the plunger 14 back to an initial position (the position shown in Fig. 1) thereof upon de-energization of the solenoid 15, and a set of movable contacts 17, 18 and a set of fixed contacts 19, 20 as motor contacts.

[0018]

One set of movable contacts 17 and 18 are a main movable contact 17, the main movable contact 17 being held in an insulated state at an end portion (upper end portion in Fig. 1) of a rod 21 of the plunger and connected to a

positive pole-side brush 11 through a lead wire (not shown), and a sub movable contact 18 connected to the main movable contact 17 through an elastic copper plate 22.

One set of fixed contacts 19 and 20 are a main fixed contact 19 opposed to the main movable contact 17 and a sub fixed contact 20 opposed to the sub movable contact 18. The main fixed contact 19 is integral with a terminal bolt 23 which is mounted through the end cover 13. The sub fixed contact 20 is connected to the main fixed contact 19 through a starting resistor 24.

[0019]

The starting resistor 24, which is formed by coiling nickel wire for example, is provided for suppressing a battery current which flows in the armature 10 upon abutment of the sub movable contact 18 against the sub fixed contact 20.

The movable contacts 17, 18 and the fixed contacts 19, 20 are constructed so that the distance between the main fixed contact 19 and the main movable contact 17 becomes larger than the distance between the sub fixed contact 20 and the sub movable contact 18 when the plunger 14 is at a standstill in its initial position (the position shown in Fig. 1).

[0020]

The output shaft 4 is aligned with a rotary shaft (armature shaft 10a) of the motor 2 on the front side (left side in Fig. 1) of the motor and is supported rotatably by both a bearing 25 held by the front housing 12 and a bearing 27 held by a center case 26. The rotating force of the armature 10 is transmitted to the output shaft 4 through a reduction mechanism and a one-way clutch both to be described below.

The center case 26 covers the outer peripheries of the reduction mechanism and one-way clutch which are disposed in the interior of the front housing 12 on the yoke 8 side.

The reduction mechanism is a planetary reduction gear which reduces the rotating speed of the armature 10 by rotating motions (rotation and revolution) of a planetary gear 28.

[0021]

The one-way clutch comprises an outer 29 adapted to rotate upon receipt of a rotational output from the reduction mechanism, an inner 30 disposed on an inner periphery side of the outer 29, and a roller 31 disposed in a wedge-like space formed between the outer 29 and the inner 30.

A revolutionary motion of the planetary gear 28 is

transmitted to the outer 29, whereby the outer 29 rotates.

The inner 30 is provided at a rear end portion of the output shaft 4 and rotates together with the output shaft.

When the outer 29 rotates upon receipt of a revolutionary motion of the planetary gear 28, the roller 31 is locked between the outer 29 and the inner 30 and transmits the rotation of the outer 29 to the inner 30. On the other hand, when the rotating speed of the inner 30 becomes higher than that of the outer 29 upon start-up of the engine, there occurs racing between the outer 29 and the inner 30 to cut off the transfer of power between the two.

[0022]

The pinion 5 has an inner helical spline formed on its inner periphery side and is disposed on the output shaft 4 in a state in which the said inner helical spline is engaged with an outer helical spline formed on the output shaft 4. With a spring 32, the pinion 5 is urged constantly in a direction (rightward in Fig. 1) opposite to the ring gear.

The pinion 5 includes a gear 5a ("pinion gear 5a" hereinafter) which comes into mesh with the ring gear (not shown) in the engine when the engine starts and also includes a flange portion 33 provided on the pinion gear 5a

on the side opposite to the ring gear. Plural concave portions 33a are formed in an outer periphery of the flange portion 33 continuously in the circumferential direction.

[0023]

In front of the pinion 5 is provided a shutter 34 for opening and closing an opening of the front housing 12 in interlock with movement of the pinion 5. The shutter 34 is pushed against a front end face of the pinion by means of the spring 32.

Behind the pinion 5 is disposed a retreat inhibiting ring 35 which inhibits the retreat of the pinion 5 in cooperation with the pinion rotation inhibiting member 6 after engagement of the pinion gear 5a with the ring gear. As shown in Fig. 2, the retreat inhibiting ring 35 is provided on an annular member fitted loosely on an outer periphery of the output shaft 4 and is supported swingably by a support portion 37 of a plate 36 disposed in front of the center case 26. Further, the retreat inhibiting ring 35 is connected to the pinion 5 through a thrust washer 38 disposed on a rear side of the flange portion 33.

[0024]

The pinion rotation inhibiting member 6 is formed by coiling a metallic rod-like member for example and both end portions thereof are bent at approximately right angles in

the same direction. The pinion rotation inhibiting member 6 is disposed movably in X-Y directions in Fig. 2 within a space formed between the center case 26 and the plate 36 and is urged constantly in X direction (upward direction in Fig. 1) by means of a spring 39 anchored to the plate 36.

[0025]

Both end portions bent at approximately right angles of the pinion rotation inhibiting means 6 are drawn out forward (the pinion 5 side) from the plate 36.

As shown in Fig. 1, one of both end portions is disposed radially outside the flange portion 33 of the pinion 5 so as to intersect the rotational direction of the pinion 5 and functions as a rotation inhibiting portion 6a (the one end portion will hereinafter be referred to as the rotation inhibiting portion 6a) which, when the pinion rotation inhibiting member 6 moves downward in the figure, comes into engagement with a concave portion 33a formed in the flange portion 33 to inhibit rotation of the pinion 5.

The other end portion is positioned on the side (see Fig. 2) opposite to the rotation inhibiting portion 6a in the radial direction of the output shaft 4 and is provided as an arm portion 6b (the other end portion will hereinafter be referred to as the arm portion 6b) on which the electromagnetic force of the electromagnetic switch 3

is exerted through the crank bar 7.

[0026]

The crank bar 7 is made up of an axially extending bar portion 7A (the first bar member in the present invention) made of metal (e.g., S35C), a transfer portion 7B (the second bar member in the present invention) connected to one end side of the bar portion 7A, and an operating portion 7C positioned on an opposite end side of the bar portion 7A.

The bar portion 7A passes inside the yoke 8 and between adjacent magnetic poles 9 substantially in parallel with the armature shaft 10a and is supported rotatably by a set of bearings (not shown).

The transfer portion 7B is formed separately from the bar portion 7A, using a metallic material (e.g., SPCC) different from the material of the bar portion 7A, and is mounted in a direction substantially perpendicular to the axis of the bar portion 7A.

[0027]

As shown in Fig. 3, one end of the transfer portion 7B is inserted into an engaging hole 40a formed in a hook portion 40 of the plunger 14, while an opposite end thereof is connected to one end of the bar portion 7A. For example, as shown in Fig. 4, the transfer portion 7B and the bar

portion 7A are fixed together in the connection of the two by press-fitting a protrusion 7a formed at one end of the bar portion 7A into a hole 7b formed in the associated end of the transfer portion 7B and by caulking a projecting end of the protrusion 7a projecting from the hole 7b. The transfer portion 7B is formed in a shape (e.g., flat shape) which, when the plunger 14 is attracted, is difficult to deflect in the attracting direction. Further, taking abrasion resistance into account, the transfer portion 7B is subjected to a heat treatment (e.g., carbonitriding).

[0028]

The operating portion 7C is integral with the bar portion 7A and is formed by bending the opposite end side of the bar portion 7A approximately at right angles. As shown in Fig. 2, a free end portion of the operating portion 7C is in abutment against the arm portion 6b of the pinion rotation inhibiting member 6. When the attractive force of the electromagnetic switch 3 is transmitted to the bar portion 7A from the transfer portion 7B to rotate the bar portion 7A, the operating portion 7C rotates integrally with the bar portion 7A and functions to push the pinion rotation inhibiting member 6 downward in the figure against the biasing force of the spring 39.

[0029]

Next, the operation of this embodiment will be described below.

When the IG switch closes (turns ON), an electric current flows from the battery mounted on the vehicle to the solenoid 15 of the electromagnetic switch 3, creating a magnetic force, whereby the plunger 14 is attracted and moves upward in Fig. 1. When this movement of the plunger 14 is transmitted to the pinion rotation inhibiting member 6 through the crank bar 7, the pinion rotation inhibiting member 6 moves in Y direction (downward in Fig. 1) and its rotation inhibiting portion 6a comes into engagement with a concave portion 33 formed in the flange portion 33 to inhibit rotation of the pinion 5.

[0030]

On the other hand, with movement of the plunger 14, the sub movable contact 18 first comes into abutment against the sub fixed contact 20 and the battery current flows in the armature 10 through the starting resistor 24, so that the armature 10 rotates at a low speed. The rotation of the armature 10 is decelerated by the reduction mechanism and is thereafter transmitted to the output shaft 4 through the one-way clutch, causing the output shaft 4 to rotate. With rotation of the output shaft 4, the pinion 5 on the output shaft also tends to rotate, but since the

rotation of the pinion 5 is inhibited by the rotation inhibiting portion 6a, the rotating force of the output shaft 4 is applied to the pinion 5 as a thrust force to push out the pinion axially under the helical splining action.

[0031]

When the pinion 5 advances on the output shaft 5 and the pinion gear 5a comes into mesh with the ring gear, the rotation inhibiting portion 6a is disengaged from the flange portion 33 and gets in behind the retreat inhibiting ring 35, whereby the pinion 5 is released from its rotation -inhibited state and at the same time the retreat of the pinion is inhibited.

Thereafter, when the main movable contact 17 comes into abutment against the main fixed contact 19, the starting resistor 24 is short-circuited and a rated voltage is applied to the motor 2, whereby the armature 10 rotates at a high speed. As a result, the rotating force of the armature 10 is transmitted from the pinion gear 5a to the ring gear, with cranking of the engine.

[0032]

Thereafter, when the engine starts and the IG switch is opened (turned OFF), the current flowing in the solenoid 15 of the electromagnetic switch 3 is cut off and the

magnetic force vanishes, so that the plunger 14 is pushed back to its initial position by means of the spring 16. With this movement of the plunger 14, the bar portion 7A of the crank bar 7 rotates in a direction opposite to the start-up direction, so that the operating portion 7C rotates together with the bar portion 7A to release the urging force (pushing-down force for the pinion rotation inhibiting member 6 in Fig. 2) acting on the arm portion 6b of the pinion rotation inhibiting member 6.

[0033]

Consequently, the pinion rotation inhibiting member 6 is pushed back in X direction in Fig. 2 (upward in Fig. 1) by the spring 39 and the rotation inhibiting portion 6a comes out from behind the retreat inhibiting ring 35, so that the pinion 5 is released from its retreat-inhibited state and retreats on the output shaft 4 under the biasing force of the spring 32 and a retreating force which the pinion receives from the ring gear, returning to its rest position shown in Fig. 1.

[0034]

(Effect of the First Embodiment)

In the starter 1 of this embodiment, the crank bar 7 for transmitting the attractive force of the electromagnetic switch 3 to the pinion rotation inhibiting

member 6 is divided in two and the divided portions are combined with each other. That is, the transfer portion 7B of the crank bar 7 is formed separately from the bar portion 7A and the operating portion 7C, so that the assembling performance of the starter 1 is greatly improved. For example, at the time of inserting one end of the transfer portion 7B into the engaging hole 40a formed in the hook portion 40 of the plunger 14, this inserting work can be done in a separated state of the transfer portion 7B from the bar portion 7A and thus the assembling work is easier than in the case where the crank bar 7 is formed as an integral member from the operating portion 7C up to the transfer portion 7B.

Besides, since the crank bar 7 is divided in two, it is possible to effect assembly (for example, a successively stacking process from the pinion 5 side with the front housing 12 on the bottom) in one axial direction and hence possible to carry out mass production.

[0035]

Moreover, since the bar portion 7A and the transfer potion 7B are divided from each other, both can be formed using different materials and hence it is possible to use materials suitable for respective purposes (e.g., S35C for the bar portion 7A and the operating portion 7C, SPCC for

the transfer portion 7B). Further, the sectional shape of the bar portion 7A and that of the transfer portion 7B are not required to be the same. For example, therefore, the transfer portion 7B may be formed in a flat shape which is difficult to deflect in the attracting direction when the plunger 14 is attracted, while the bar portion 7A may be formed in a shape (circular section) difficult to deflect against twisting. On the other hand, if the crank bar 7 is formed as an integral member, it is difficult to effect machining into different sectional shapes according to purposes, but the division facilitates the machining (for example, the transfer portion 7B can be formed in a flat shape easily with a press or the like).

[0036]

The transfer portion 7B is required to possess abrasion resistance because one end portion thereof is inserted into the engaging hole 40a of the hook portion 40 and slides. In this case, this requirement can be met by subjecting only the divided transfer portion 7B to a heat treatment (e.g., carbonitriding).

Further, since the bar portion 7A and the transfer portion 7B can be fixed at an appropriate position after assembly thereof, it is not necessary to enhance the machining accuracy of the crank bar 7 and the assembly

accuracy of the electromagnetic switch 3. As a result, the fabrication of the crank bar 7 and that of the mounting parts of the electromagnetic switch 3 become easier, thus permitting the reduction of cost.

[0037]

(Second Embodiment)

In this embodiment, as shown in Fig. 5, a bar portion 7A and a transfer portion 7B of a crank bar 7 are formed integrally with each other, while the bar portion 7A and an operating portion 7C are divided. Also in this case, as is the case with the first embodiment, it is possible to obtain the effects resulting from the divided structure of the crank bar 7.

In the assembling process for the starter 1, it is possible to effect a successive upward stacking from the electromagnetic switch 3 side with the end cover 13 on the bottom, thus permitting mass production.

Further, a free end side of the operating portion 7C engages the arm portion 6b of the pinion rotation inhibiting member 6 and slides. Taking abrasion resistance into account, it is easy to apply a heat treatment to the operating portion 7C.

[0038]

(Third Embodiment)

In this embodiment, a crank bar 7 is divided into three portions. For example, as shown in Fig. 6, the crank bar 7 is divided into and assembled by a bar portion 7A, a transfer portion 7B, and an operating portion 7C. In this case, not only the same effects as in the first and second embodiments are obtained, but also, since the division is made at both bent portions of the crank bar 7, it is not necessary to bend the crank bar 7 and hence it is possible to omit the crank bar bending process, whereby the crank bar 7 can be fabricated easily and less expensively.

[0039]

In the first embodiment, when assembling the bar portion 7A and the transfer portion 7B, the protrusion 7a formed at an end of the bar portion 7A is press-fitted into the hole 7b formed in an end of the transfer portion 7B and a projecting end of the protrusion 7a projecting from the hole 7b is caulked and fixed thereby, but there may be adopted any other fixing means (e.g., screwing or welding). This is also applicable to fixing the bar portion 7A and the operating portion 7C in the second and third embodiments.

[Brief Description of the Drawings]

Fig. 1 is a sectional view of a starter;

Fig. 2 is a front view of a retreat inhibiting ring

and the vicinity thereof as seen from a pinion side;

Fig. 3 is a partial sectional view as seen from an end cover side;

Fig. 4 is an enlarged view showing a connection between a bar portion and a transfer portion;

Fig. 5 is an entire view of a crank bar (second embodiment); and

Fig. 6 is an entire view of a crank bar (third embodiment).

[Explanation of Reference Numerals]

1 starter

2 motor

3 electromagnetic switch

4 output shaft

5 pinion

6 pinion rotation inhibiting member

7 crank bar

7A bar portion (first bar member)

7B transfer portion (second bar member)

7C operating portion (second bar member)

10 armature

10a armature shaft (rotary shaft of the armature)

14 plunger

[Name of Document] Abstract

[Summary]

[Subject]

A starter 1 is to be provided which can improve the assembling performance and which permits easy fabrication of a crank bar 7.

[Solution]

A crank bar 7 which actuates a pinion rotation inhibiting member 6 by utilizing an attractive force of an electromagnetic switch 3 comprises a metallic bar portion 7A extending axially and radially outside an armature 10, a transfer portion 10B formed separately from the bar portion 7A and connected to one end side of the bar portion 7A, and an operating portion 7C formed by bending an opposite end side of the bar portion 7A approximately at right angles.

According to this construction, for example at the time of inserting one end of the transfer portion 7B into an engaging hole formed in a hook portion 40 of a plunger 14, this assembling work can be done in a separated state of the transfer portion 7B from the bar portion 7A and is therefore easy. Besides, since the crank bar 7 is divided in two, it becomes possible to carry out the assembling work in one axial direction, thus permitting mass production.

[Selected Drawing] Fig. 1

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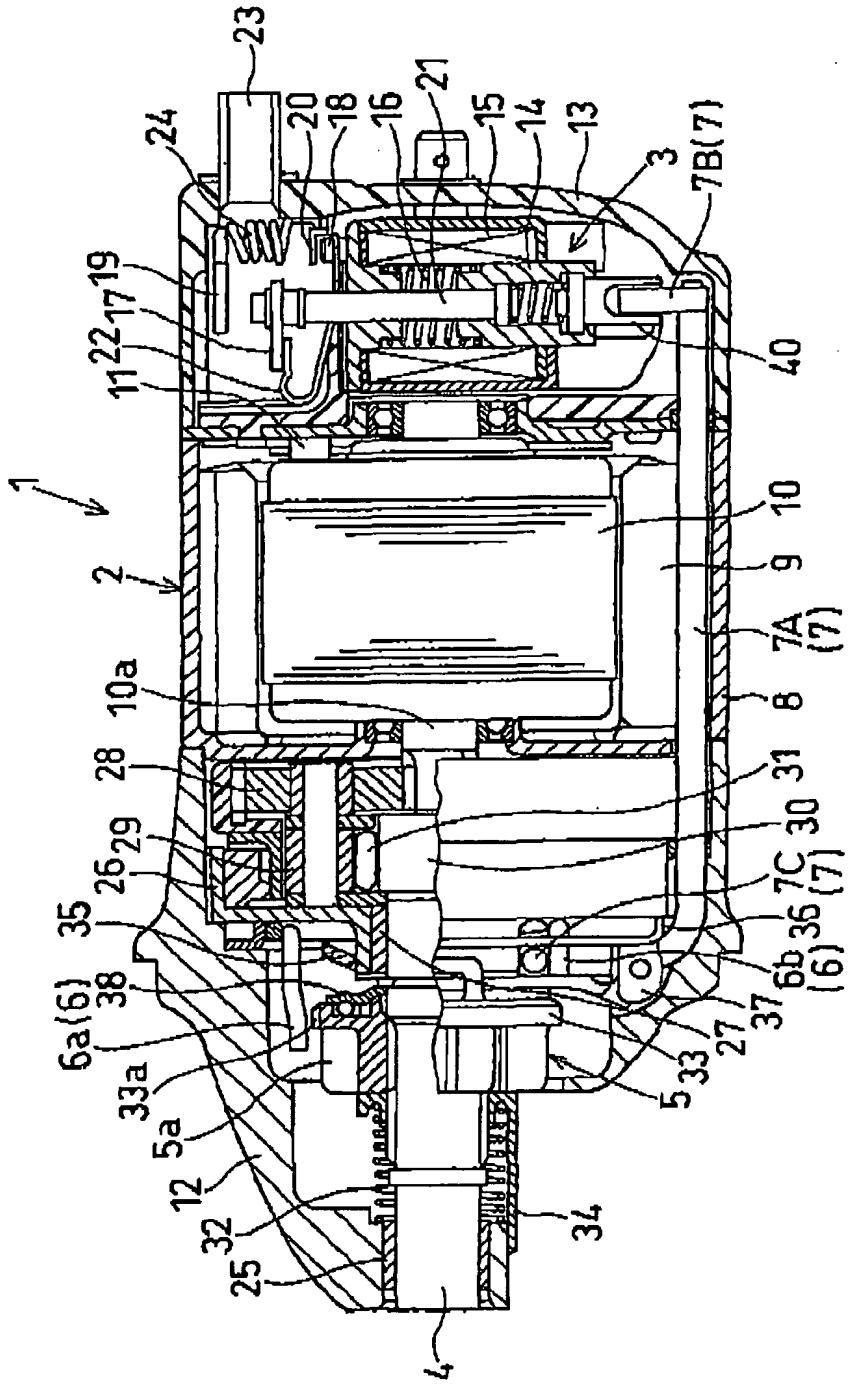
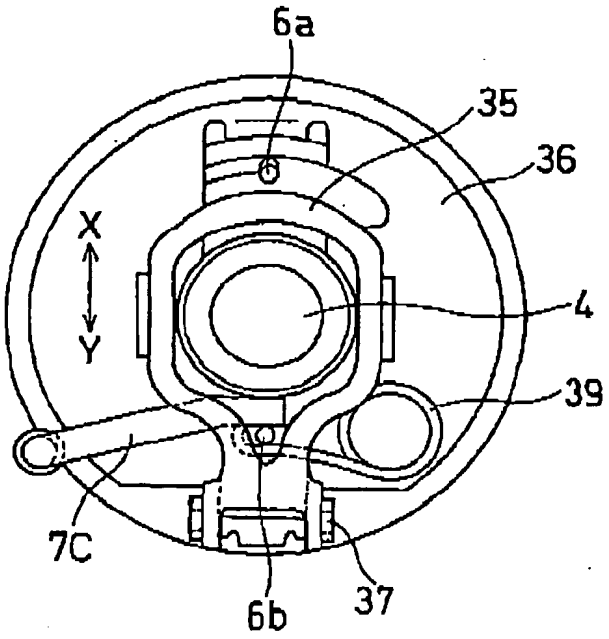
整理番号＝Ｐ１４－１２－００８ 頁: 1/ 4

【書類名】 図面 [NAME OF DOCUMENT] DRAWING

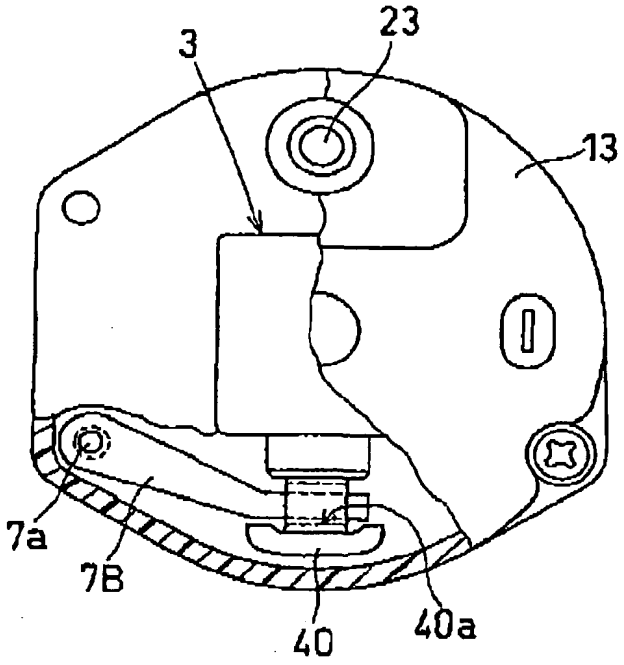
【図１】 FIG. 1



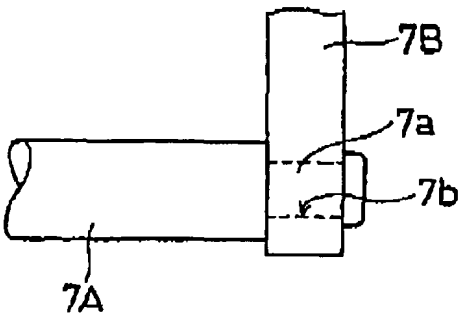
【図２】 FIG. 2



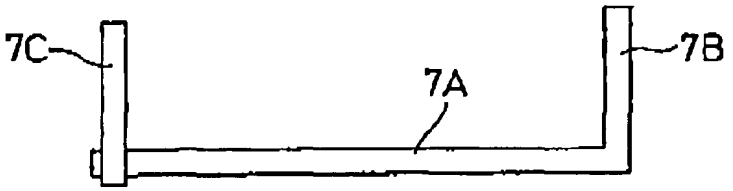
【図３】 FIG.3



【図４】 FIG. 4



【図５】 FIG. 5



【図６】 FIG. 6